

CLAIMS

1. A laser cutting apparatus for cutting sheet materials comprising:
a bed having a top surface for a sheet material to be positioned thereon, a gantry
5 being arranged to controllably travel in a first direction along the bed and
configured to extend over the bed in a second direction that is substantially
transverse to the first direction, and a carriage being arranged to controllably travel
along the gantry; the bed having a holding arrangement for holding the sheet
material in position on said bed, a laser head located on the carriage and having a
10 laser nozzle arranged to receive a laser beam from a laser source and to direct the
laser beam through the laser nozzle and towards the bed for cutting the sheet
material, an enclosure member having a first low pressure chamber therein being
arranged about the laser nozzle, the first chamber being arranged so that the
pressure therein is lower than atmospheric pressure and having at least one suction
15 opening positionable beneath the laser nozzle for entraining substantial by-products
produced during cutting of the sheet material into the first chamber and for causing
a part of the sheet material under the suction opening to be lifted off the top
surface.
2. The apparatus according to claim 1 wherein the holding arrangement
20 includes a second low pressure chamber arranged below the bed and a plurality of
through holes extending through the top surface and in fluid communication with
the second chamber, the second chamber being arranged so that the pressure
therein is lower than atmospheric pressure, thereby causing by-products below the
sheet material to be drawn into the second chamber.
- 25 3. The apparatus according to claim 2 wherein a relatively high volume low
pressure air is arranged to flow through the holes into the second chamber.
4. The apparatus according to claim 2 or 3 wherein the first chamber and the
second chamber are substantially vacuum.
5. The apparatus according to one of claims 2 to 4 wherein air flows through
30 the first and second chambers being controlled so that there is an air gap between

the suction opening and the lifted part of the sheet material, thereby causing air to flow through the air gap and into the first chamber.

5 6. The apparatus according to any one of claims 1 to 5 wherein one or more controllable crease wheels being arranged on the carriage for forming creases in the sheet material.

7. The apparatus according to claim 6 wherein the wheel or each of wheels having a relatively large diameter in comparison to said through holes.

10 8. The apparatus according to claim 6 or 7 wherein the wheel or each of the wheels being configured with a profile to limit depth of creases in the sheet material.

9. The apparatus according to claim 8 wherein the wheel or each of the wheels having a main wheel body and at least one edge portion extending around and protruding from the main body.

15 10. The apparatus according to claim 9 wherein the wheel or each of the wheels having a single or dual edge.

11. The apparatus according to one of claims 1 to 10 wherein the carriage having a controllable gripping device for gripping a leading edge of the sheet material for positioning same on the bed.

20 12. The apparatus according to claim 11 wherein the gripping device having an upper plate and a lower plate which is controllably movable relative to said upper plate to clamp the leading edge therebetween when positioning the sheet material on said table.

25 13. The apparatus according to claim 12 wherein the lower plate is configured with a front edge having one or more pointed or curved sections forward of remaining sections of the front edge, and is arranged so that when the gripping device is moved to contact the leading edge of the sheet material the one or more pointed or curved sections make initial contact with portions of the leading edge of the sheet material before the remaining sections come into contact with the leading edge, thereby causing the initially contacted portion(s) to ride over and then
30 lie flat on said one or more pointed or curved sections.

14. The apparatus according to claim 13 wherein the front edge has a knife edge profile and is wavy shaped with one or more crests.

15. The apparatus according to claim 12 wherein the lower plate having a substantially straight front edge and is pivotally mounted at one end thereof, the
5 lower plate being controlled so that at said initial contact the front edge is at an angle to said leading edge and thereafter the lower plate is pivotally moved in a plane parallel to the flat bed

16. The apparatus according to one of claims 11 to 16 wherein the gripping device is controlled to lower its lower plate on the bed and to move to slide under
10 the leading edge of the sheet material and then to retreat a short distance before returning to clamp the sheet material.

17. The apparatus according to any one of claims 1 to 16 wherein the laser head having a cover with a series of apertures arranged to be selectively movable to a position(s) in alignment with the or each of said at least one suction opening and
15 while being moved the by-products caught in the apertures are removed by interaction with the enclosure member.

18. The apparatus according to claim 17 wherein the cover is arranged to be movably mounted on the enclosure member and a retention arrangement is provided for retaining said cover at the position(s) of alignment.

20 19. The apparatus according to claim 18 wherein the retention arrangement has spaced retention holes in said cover and the retention holes are configured to receive retention elements on said enclosure member.

20. The apparatus according to claim 19 wherein the retention elements are bearings being biased to be receptive in said retention holes when an aperture(s)
25 in said cover is in the alignment position(s), and upon applying a force to move said cover the bias on the retention bearings is overcome and the bearings thereby retreating from the retention holes to allow movement of the cover relative to the enclosure member towards a subsequent alignment position(s).

21. The apparatus according to one of claims 1 to 20 wherein the sheet material
30 is arranged in a roll form supported on rollers positioned adjacent to the bed table.

22. A laser cutting apparatus comprising:

1) one or a series of rollers on which one or more rolls of a sheet material are placed;

2) a flat bed table on which the sheet material is laid out and the bed table is arranged to hold the sheet material in place by air suction;

5 3) a gantry is arranged to move in a first direction along the table;

4) a gripping device and a controllably movable carriage mounted on the gantry, the gripping device being arranged to controllably clamp the sheet material and to pull the sheet material across the table, and the carriage being arranged to move along the gantry in a second direction which is substantially transverse to said first direction; and

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5) the carriage having mounted thereon a pair of controllable crease wheels for forming crease lines into the sheet material, and a controllable laser head for cutting the sheet material.

23. A laser head for a sheet material cutting apparatus, the laser head comprises a laser nozzle arranged for connection to a laser source and to direct a laser beam generated from the laser source therethrough and towards the sheet material, and an enclosure member being arranged about the laser nozzle and having a first low pressure chamber therein. the first chamber is arranged so that the pressure therein is lower than atmospheric pressure and has at least one suction opening positionable beneath the laser nozzle for entraining substantial by-products produced during cutting of the sheet material into the first chamber, a cover having a series of apertures is arranged to be selectively movable to a position(s) in alignment with the or each of said at least one suction opening and while being moved the by-products caught in the apertures are removed by interaction with the enclosure member.

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24 The laser head according to claim 23 wherein the cover is movably mounted on the enclosure member, and a retention arrangement is provided for retaining said cover at the position(s) of alignment.

25. The laser head according to claim 24 wherein the retention arrangement has spaced retention holes in said cover and the retention holes are configured to receive retention elements on said enclosure member.

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26. The laser head according to claim 24 wherein the retention elements are bearings biased to be receptive in said retention holes when an aperture(s) in said cover is in the alignment position(s), and upon applying a force to move said cover the bias on the retention bearings is overcome and the bearings thereby retreating
5 from the retention holes to allow movement of the cover relative to the enclosure member towards a subsequent alignment position(s).

27. A gripping device for a cutting apparatus having a flat bed table on which a sheet material to be cut is laid out, the device comprises an upper plate member and a lower plate member arranged to be movable relative to said upper plate
10 member between a clamping position for clamping the sheet material therebetween and a pickup position for picking up the sheet material, the plate members being arranged to move in a first direction along the table and to controllably clamp a leading edge of the sheet material, the lower plate is configured with a front edge
15 opposite to said leading edge and is arranged so that at said pickup position movement thereof to contact the sheet material causes a relatively small part or parts along the leading edge to come into an initial contact with the front edge and further movement thereof causes other parts along the leading edge to progressively come into contact with the front edge and to lie over the front edge for clamping between the upper and lower plate members.

20 28. The device according to claim 27 wherein the front edge has a knife edge profile and is wavy shaped with one or more crests.

29. The device according to claim 27 wherein the lower plate has a substantially straight front edge in a knife edge profile and is pivotally mounted at one end thereof, the lower plate being controlled so that at said initial contact the front edge
25 is at an angle to said leading edge and thereafter the lower plate is pivotally moved in a plane parallel to the flat bed of said table so that the front edge is substantially parallel to said leading edge.